Vol. 5 No. 1

JANUARY, 1949

SPE NEWS

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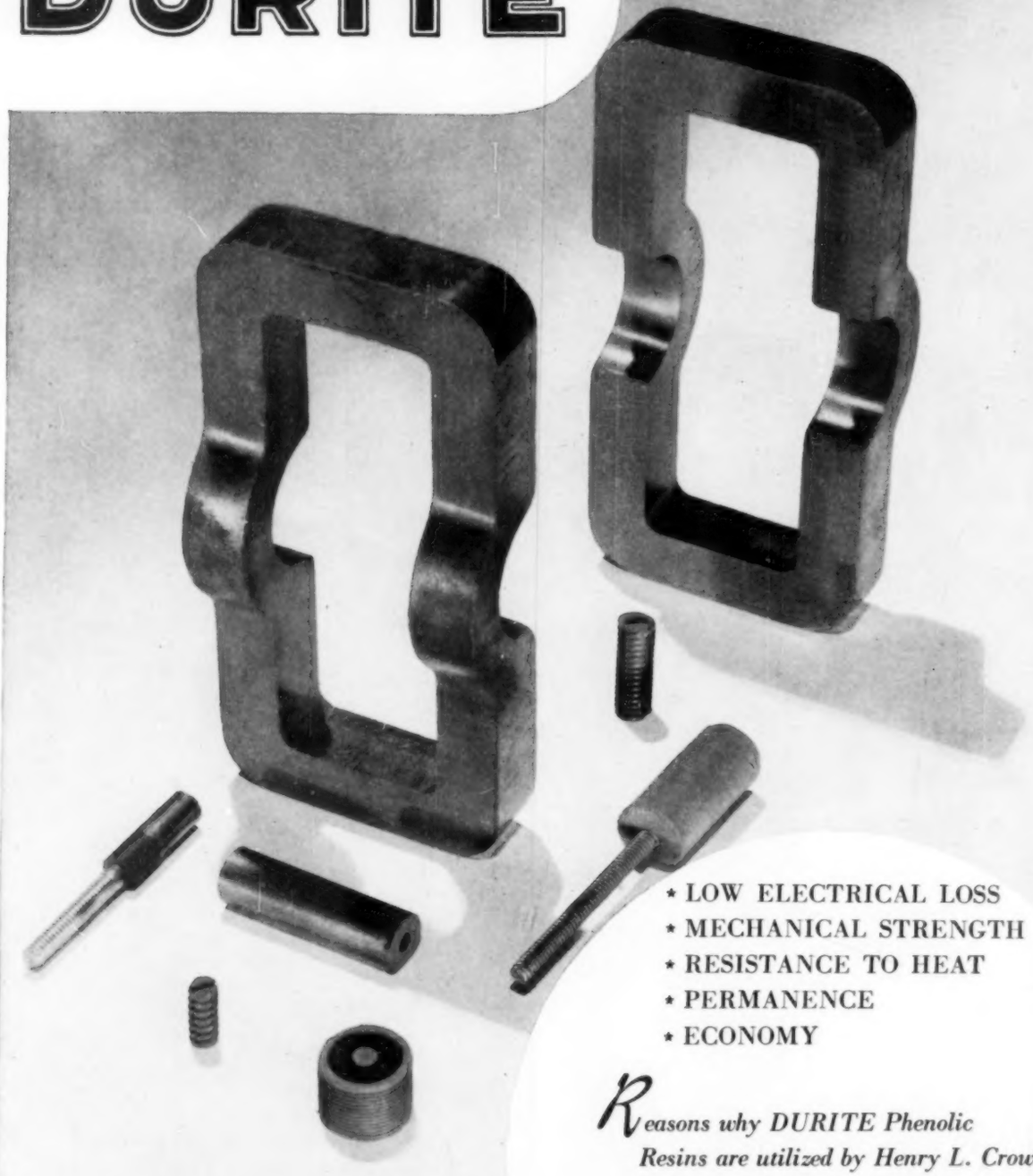

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SPE NEWS

Issued Monthly to all Members of the Society of Plastics Engineers

Volume 5 **Number 1**

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Philadelphia Section

Prize Paper Contest Winners Announced

The winners of the second annual SPE Prize Paper Competition were decided just as this magazine was going to press. This competition was entered by members from the Pacific Coast to the Atlantic Coast. The honor of first prize was taken by the paper "Empirical Factors in Injection Machine Design" submitted by A. R. Morse, service engineer for the Reed-Prentice Corporation. It is our great pleasure to present in this issue of the SPE News the first prize paper, which presents a number of ideas which may at first startle many readers, but they are ideas which have been gained through years of close association with both the machine makers and molders, and first-hand acquaintance with the problems of the plastics molder. Whether or not you agree with his ideas, you will at the very least find them fresh and stimulating. The monetary value of the first prize is two hundred dollars.

Ronald D. Beck, winner of the one hundred dollar second prize is plastics development engineer at the Plastics Division of the Continental Can Co. Co-author of the book "Applied Plastic Product Design", he graduated from Oberlin College and took graduate work at Ohio University.

Third prize was tied for by Ervin Silver of the Naval Ordnance Laboratory at Washington, and Warren V. Prince of the Southern California Section. Warren V. Prince was one of the earliest members of the Cleveland Section, and the originator of the SPE News, which he first put out as a mimeographed sheet.

Since this selection of winners was made just as the magazine was being

(Please turn to Page 23)

It pays to use your custom molder's know-how

Say the Revere Men in Rome, N. Y.

No. 1 in a series on Plastics Skill at work...

PRECISION PLANNING improves plastic parts design. Norton development engineer uses vernier height gauge to position front assembly hole on customer's model in perfecting new handle.

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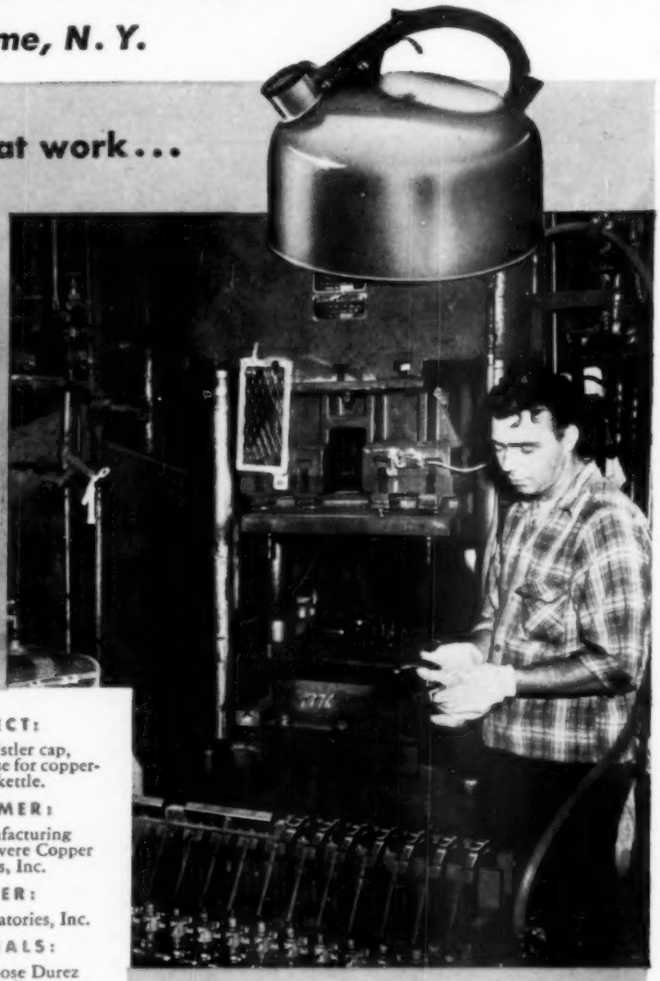
CUSTOMER:
Rome Manufacturing Division of Revere Copper and Brass, Inc.

MOLDER:
Norton Laboratories, Inc.

MATERIALS:
General purpose Durez phenolic in handle, steam-resistant Durez in cap, polyamide trigger.



CREATIVE ENGINEERING speeds output, lowers cost. Duplex ram plunger press remodeled by molder cuts cure time. Shrink fixture in foreground assures accurate assembly, prevents waste.

● Next time your plans suggest consideration of plastics, why not call in your custom molder early—when he can serve you to best effect?

Example: Tools of a good housekeeper's "dream kitchen", a new line of Copper-Clad Stainless Steel Revere Ware shows the value of having experienced plastics molders cooperate in product development.

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FIRST PRIZE

Second Annual SPE Prize Paper Contest

EMPIRICAL FACTORS IN INJECTION MACHINE DESIGN

By A. R. MORSE*

The injection machine of tomorrow will be designed NOT by a theoretical engineer with a slide rule, but by a practical manufacturer with the courage o build an injection machine around a heater six feet long.

OUTLINE

Real development of injection machinery to date has proceeded strictly on an empirical rather than a theoretical engineering basis. Because designing engineers are unfamiliar with thermoplastic materials, forthcoming molds, and active job trends in injection molding shops, modern injection machine design today lags far behind the molders' current requirements.

By examining some of the recent developments among injection molders, and by recognizing the overwhelming importance of empirical design factors, many desirable features of future injection machines can be high-lighted to the distinct advantage of both the injection molder, and the various companies producing this now highly specialized equipment.

The bibliography appended to this paper indicates the very limited technical literature pertinent to injection machinery. Few problems underlying injection molding equipment designs ever reach the technical trade journals. From experience, often of a very costly nature, the molder has learned that he must prove in actual use the fond advertizing claims of the equipment manufacturer. As a result, modern injection machines incorporate countless rule of thumb improvements devised by the molder.

This paper presents for the first time, a series of empirical observations based entirely on injection machines in actual use, and the conclusions reached herein lead to suggestions for the design of a specific 24 ounce injection machine which will not only meet but anticipate the molder's requirements.

* *Service Engineer, Reed-Prentice Corp.*
The ideas expressed in this paper are those of the author and do not necessarily represent the opinion of the editors of the SPE News or of the Reed-Prentice Corp.

1. PATENTS AND FUTURE INJECTION MACHINES.

The patent situation in the injection machinery field is seldom taken seriously by manufacturers. The writer believes that most of the design features of future injection machines will not be sustainable by patents.

Many injection machine patents, such as the famed Gastrow patent (No. 2,057,945) which provided that the walls of a heating chamber converge in a ratio calculated to follow the change in bulk factor of the material as it melts, have been proven to be of negligible value from a practical viewpoint. In the Gastrow patent, for example, the element of time, and the very slow rate of heat transfer of the thermoplastics was overlooked. Almost weekly developments are announced in the thermoplastic material field which make present heaters more and more obsolete. Since our knowledge of future machines will largely come second-hand (from the molder himself, since NO manufacturers have any research programs) it can be concluded that the injection machines of tomorrow will be covered by few if any patents.

2. HISTORICAL AND BACKGROUND ASPECTS OF INJECTION MACHINE DESIGN.

The development of the modern injection machine has been largely paced by the available thermoplastic materials and their application. Today, with our knowledge of the vinyls, polyethylenes and nylons, we should be thinking in terms of specialized chambers instead of the old multi-purpose plastifying chambers. A modern nylon installation, for example, requires a very minimum of FOUR pyrometers, instead of the conventional two or three. Enough is known of modern materials so that we could easily anticipate future designs of heaters if only the empirical factors in heater design could be made explicit. But the background of the injection machinery picture is most unusual. What is quite obvious to the molder is barely understod by our equipment manufacturers, who almost without exception are concerned primarily with the design of other varieties of machinery in fields totally unrelated to injection molding!

No manufacturers have as yet perceived the real volume potential in properly designed and serviced injection machines. Most if not all of them merely regard injection machinery as a (dubious) sideline to their staple products. A super-cautious policy has to date precluded much-needed specialized engineering, and service and sales policies are not being specifically adapted to this particular industry.

Concerns which build injection machines are geared to a much more leisurely cycle of development surrounding machine tools, presses, and other established, long-life products whose field service requirements are small, and new designs are long in appearing. When it appeared that radical changes in injection machine design are required every 2-3 years

(Please turn to Page 5)

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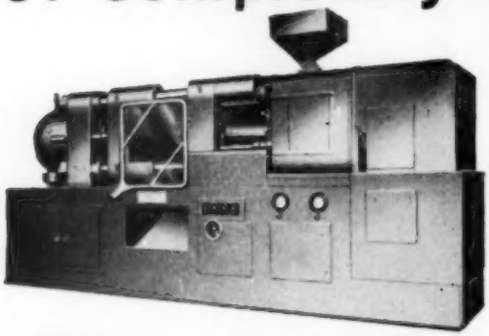

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COMPRESSION MOLDING MACHINES

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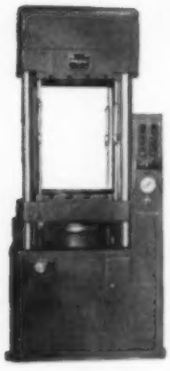

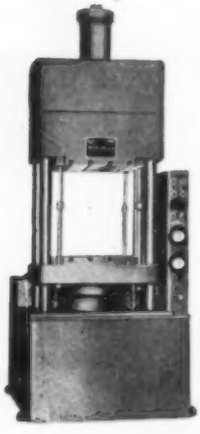

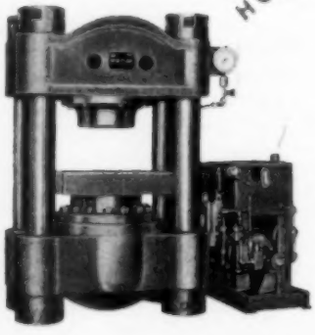

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Empirical Factors in Injection Machine Design

(Continued from Page 3)

instead of every 15-20, many manufacturers proved unable to adapt to the trends. Engineers could not be permitted to specialize in new materials, new mold designs, or in new developments in hydraulics which presage new machines. The injection machine field today is kind of an industrial orphan, and the chief competition it encounters is actually within the plants of the manufacturers themselves!

This trend has continued, and several new concerns found it profitable to introduce new machines to meet these rapidly changing conditions. Recently new machines, however, have brought no new basic concepts in injection machine function or design. Today, this fact offers excellent opportunities for the construction of new and refined types of injection machines by concerns whose managements will permit the specialized type of engineering and sales engineering necessary to determine the molders' needs with accuracy, and then to translate them into terms of the injection machinery which can be manufactured at a profit in spite of changing conditions.

The injection machine of the future must therefore be based on a simplified conception of the injection machine which will permit greater flexibility to meet the need to handle larger or smaller dies, or to use a longer or a shorter heater as conditions dictate. It is toward the projection of such a design that the present paper is aiming.

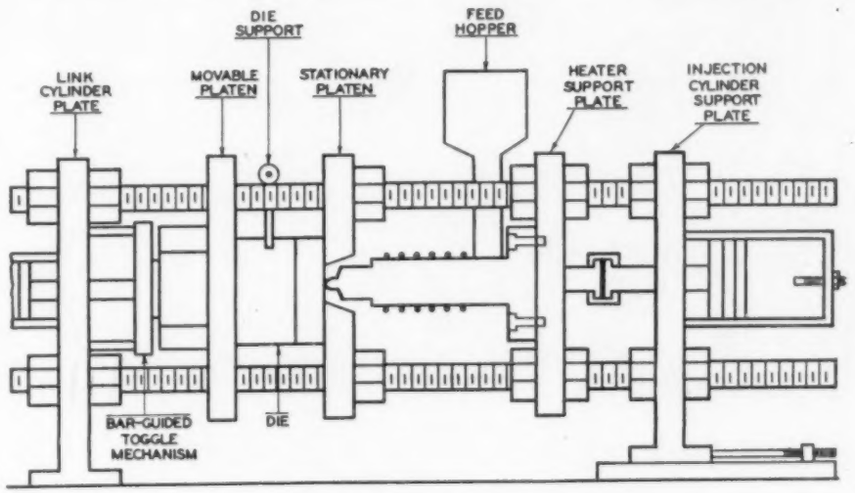
3. CURRENT TRENDS IN INJECTION MOLDING

In 1947-8, molders began abruptly to increase the number of cavities being molded. This trend, coupled with the marked drift toward ever larger parts, has gradually compelled the injection machine makers to admit that a 12-16 ounce machine will supersede the 8 ounce in importance all in a space of less than 18 months. It required nearly 5 years for the 8 ounce machine to displace the older 4 ounce models. Acceptance by the radio and refrigerator industry of thermoplastics on a large scale indicate that the 24 ounce machine may also replace the present 12-16 ounce machines with equally great rapidity. The main emphasis of this paper, therefore, is directed toward perfection of an example of a 24 ounce machine which will sell widely (approximately 300 machines within 2-3 years after its appearance). Current trends in injection molding indicate that the acceptance of such a machine will be almost automatic when and if it is offered to the trade.

4. HEATER DESIGN

Recent experiments indicate that ALL future heaters must be lengthened to meet the requirements of modern thermoplastic materials. In nylon molding for example, the material is extraordinarily slow to melt (absorb heat). Intense heat applied over a brief space-time interval is by no means as effective as moderate heat applied over a longer horizontal distance with a consequent longer TIME OF EXPOSURE of a thinner layer of material. This point is repeatedly overlooked because with the severe limitations of present machine designs and machine bases it is virtually impossible to lengthen the heater.

The ideal machine, therefore. will have a base or a stand which permits a heater of virtually any required length to be installed without extra expense. A simple method of accomplishing this aim is shown in Sketch No. 1. It will be noted that the old conception of machine bases has been entirely eliminated in favor of any inexpensive pedestal mount permitted by use of the simple and accessible power unit described beyond, and which can be mounted separately from the machine to which it is connected by flexible hoses.



SKETCH No. 1
Side view showing Stand Type Mount

Only a portion of the machines in use today have as many as 6 shots in reserve in the heater at full capacity on a competitive cycle. Only by using a heater which will have 10-15 shots in reserve, stored in a longer heater at a much lower ambient temperature, can the machine builder actually anticipate the molders' demands as far as heater performance goes. The conclusion cannot be escaped that future machines must be able to accommodate heaters of lengths as yet untried. The heater suggested for the empirical 24 ounce machine toward which this paper is aimed will be at least five feet long (60 inches), in the heated zone, not including the feed receiving chamber.

Cleaning and dismantling heaters has been a bugbear to molders from the outset. Purging larger heaters upon material changes has become distinctly expensive. Heaters must be made less costly to permit a separate unit to be used for each material, and a simpler heater construction must be adopted.

A simpler design of heater will eliminate the double shell construction often used, giving markedly more efficient heat transfer. It will permit molders to dismantle heaters for cleaning without getting into expensive major heater repair problems requiring special heavy fixtures and tools. It will also allow better arrangement of heater bands, and permit full choice of thermo-couple location as experience is gained with longer heaters.

Heater bands and controllers can readily be arranged so as to be most effective for molding vinyls, acetates, or styrenes in succession without the difficulties encountered in the present ineffecient multi-purpose heaters. A simple type of heater, also suitable for most nylon molding when a simple baffle plate is added, is outlined in Sketch No. 2. Note that the internal heater diameter does not change through the length of the heater, except to converge at the nozzle, and that straight boring only is needed except for the shallow nozzle section which is easy to reach for machining.

A single exterior diameter permits use of bands of a uniform size to be slid along to the right location for the particular job. All heater assembly bolts are eliminated, as ex-

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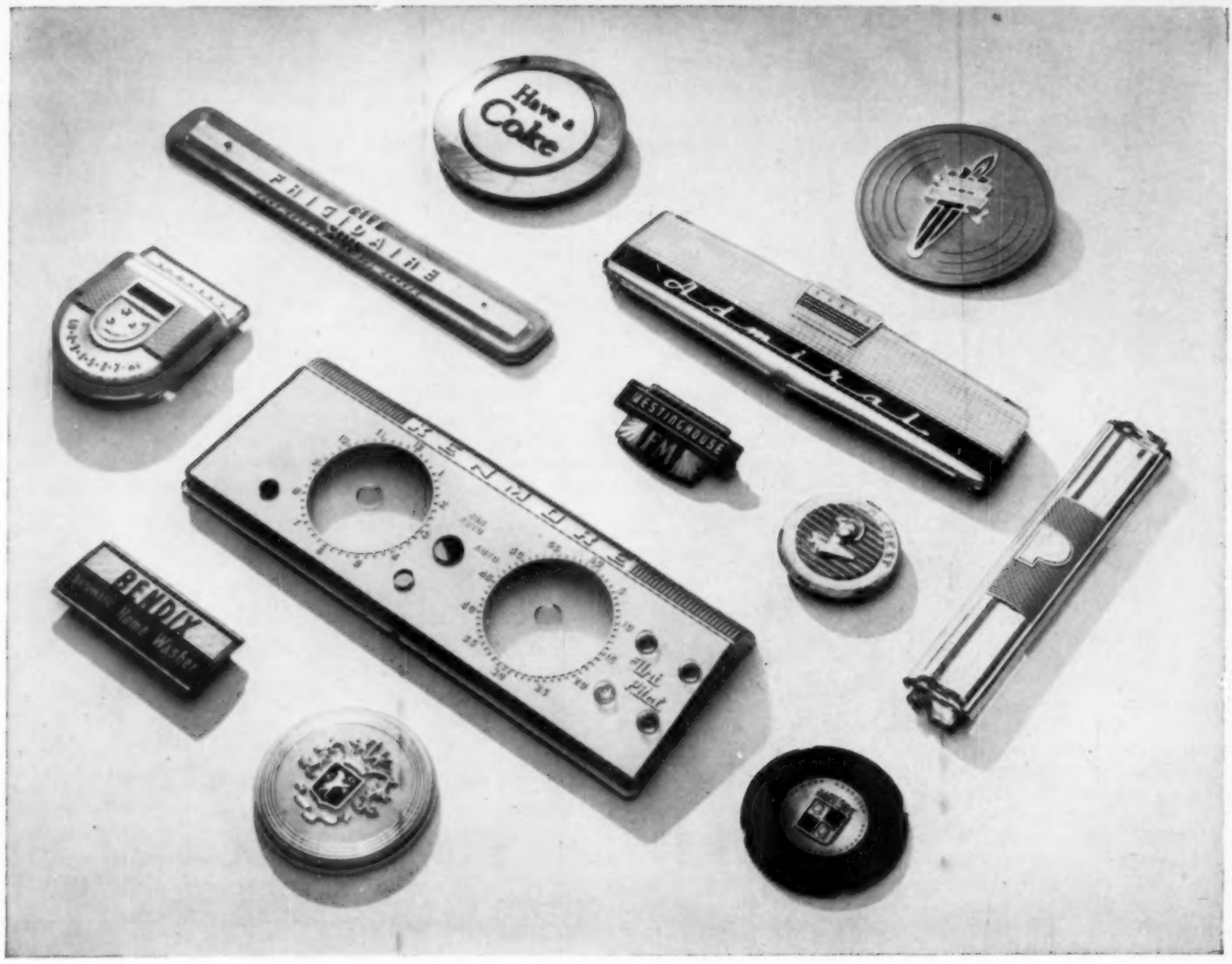

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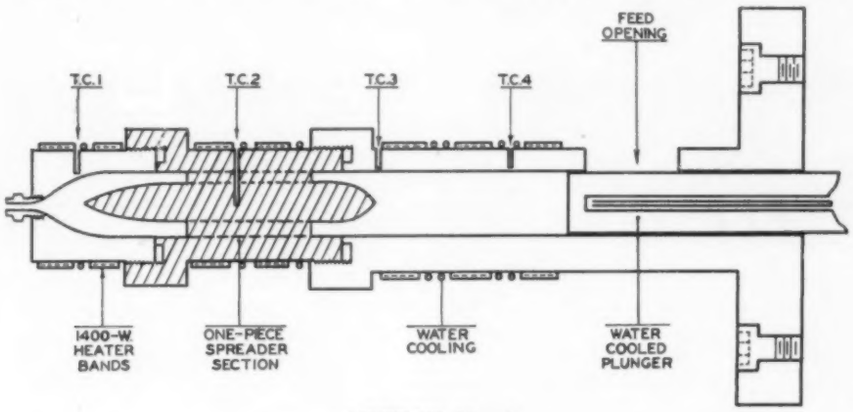
Empirical Factors in Injection Machine Design

(Continued from Page 5)

periments prove threaded collars of the type indicated will provide adequate joint seals. It is also to be noted that the spreader section is machined from solid steel. No internal lapping or fitting of the spreader is required because too little is known of the expansion factor of the heater body under heat and pressure which ultimately results in a loose fit between a floating spreader and the shell, where material can lodge and burn.



SKETCH No. 2
Heater (T. C. - Thermocouple Location)

Higher wattage bands (1400 watts) are specified than the conventional 1000 watt bands now used, and an indicator is used to show spreader temperature. Up to six or even eight pyrometer controllers will be required to regionalize the heat in a modern heater. And full length COOLING will further refine the molders' control.

Because overheating of modern materials has become destructive not only to themselves but also to the heater in many cases, and because high operating temperatures (in the range of 650-800° F) are now frequently seen, it has just been mentioned that some method of COOLING the heater itself must be made. This can be done most easily by the use of a copper tubing wound around the heater. Boring the heater itself, or welding over a water chamber is not recommended because rust and scale form under the action of heat and (hard) water, and the tubing is at least easily replaced.

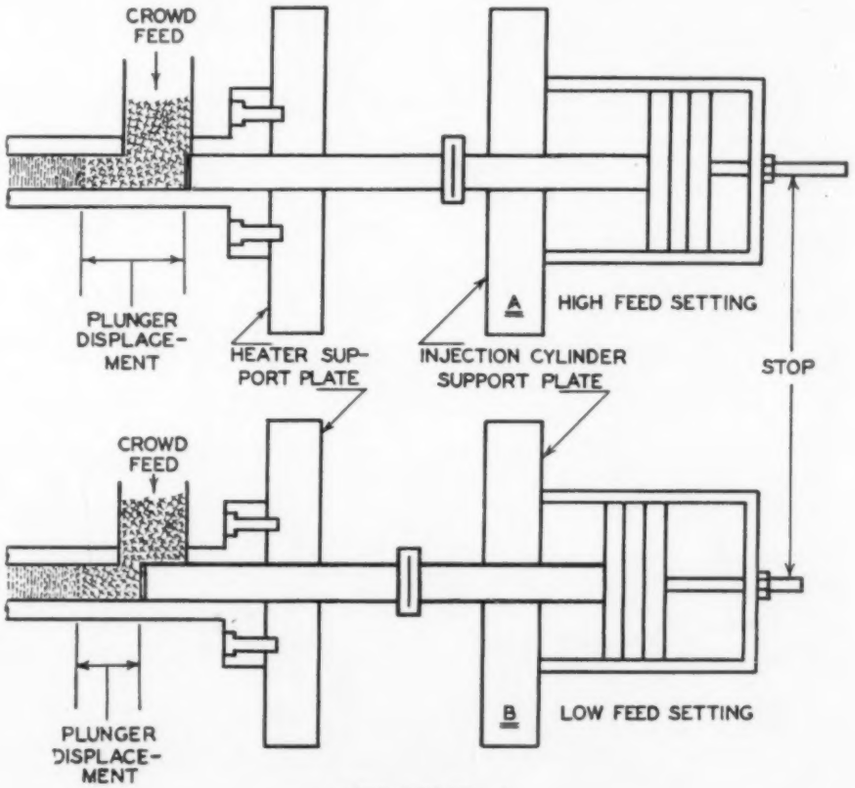
Complete elimination of feed chamber cooling as such is a foregone conclusion. Future injection plungers themselves will be watercooled internally by conventional hollow tube methods. A cooled plunger with ample tolerance (.008 per side) can push on partially plastified material without scoring or sticking. Radical concepts like the proposed cooling of the entire injection machine heater will take root only slowly among present designing engineers, although extruders have already paved the way for this development. Only by using smaller masses of metal and giving the molder full control over temperatures in BOTH directions will he be able to accomplish the necessary control over the melting and fusion of the new high melting point thermoplastics which are opening up new applications every day. In a word, the injection machine of tomorrow will be designed **not** by a theoretical engineer with a slide rule, but by a practical manufacturer with the courage to build an injection machine around a heater six feet long.

5. FEED MECHANISM

Present feed mechanisms are a source of much trouble, and are not capable of fine enough adjustment, nor do they have sufficient range to accommodate modern materials which can vary quite widely both in bulk factor and specific gravity, as for example, fluffy reground polyethylene contrasted with acetate cubes.

The type of adjustments indicated below in this paper for achieving full flexibiilty of injection machine segments, now permits the writer to suggest the elimination of the feed mechanism from the contemplated machine. Simply by mounting the heater on its own support plate, and by mounting the hydraulic cylinder for the injection unit on a separately adjustable plate, we can now permit the injection plunger to enter the heater a greater or a lesser distance, so as to give a definite proportioning action to each shot. Even further refinement in feed control will be obtained by using a simple stop belt projecting through the injection cylinder head to permit the backward position of the plunger to be set so that an exact amount of material can be received into the feed chamber ahead of the plunger. This relationship of the plunger displacement to the capacity of the mold is outlined in Sketch No. 3.

(Please turn to Page 9)



SKETCH No. 3
Plunger Travel Setting in relation to Feed Chamber to eliminate feeding device

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Bakelite Corporation
Bound Brook, New Jersey
MR. PAUL D. ZOTTU
Newton, Massachusetts

1946 – DR. JOHN J. GREBE
Dow Chemical Company
Midland, Michigan

1947 – JOHN D. COCHRANE, JR.
Formica Insulation Company
Cincinnati, Ohio

CPD-1

Empirical Factors in Injection Machine Design

(Continued from Page 7)

A crowd feed direct from a barrel-sized hopper can now be directed into the feed cylinder, and yet the machine can be closely set to discharge only the amount of material determined by the actual displacement of the plunger. The potential importance of this vital adjustment to the injection industry cannot be over-stressed, although the concept is an extremely simple one.

Furthermore the elimination of the single housing for the injection unit, and the use of independent mountings as can be observed in Sketches Nos. 4 and 5 for the heater and for its hydraulic cylinder, will be important in lowering manufacturing costs. The heater can be more easily installed and removed. Plungers can now be changed without removing the heater, and heaters of different lengths can be easily installed to suit the particular job without changing the hydraulic cylinder. All of the limitations of the conventional housing and conventional base have been done away with.

But the most important factor will be the adjustment for plunger displacement which can eliminate present feed mechanisms altogether, and for that reason this vital feature has been discussed under the present heading.

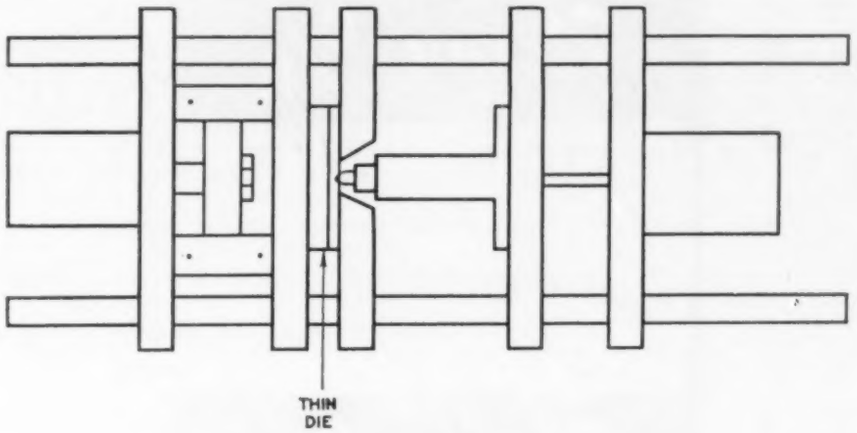
6. MOLD SPACE ADJUSTMENT

A thorough knowledge of dimensions of present molds, as well as the trend toward deeper parts (eg. battery boxes) and large flat parts (eg. refrigerator trim and panels) provides an irrefutable argument against any sacrifice of mold adjustment range vital to 90% of all molders. Future machines should be designed so as to have virtually no limitation on mold height, either minimum or maximum.

Many limitations in machine design result from the use of a frame type construction. The most severe limitation is in connection with mold height. Greatly increased costs of cast or plate type frames will undoubtedly see this type of machine replaced by the tie bar type. For these and other reasons of design and manufacture beyond our present scope, the indicated machine will have a tie bar construction, and a link mechanism which is hydraulically actuated. (Use of a full hydraulic type clamp is not considered because of current costs, high pump maintenance costs, and the fact that 9 out of 10 molders concede that the full hydraulic clamp is easier to flash than the positive mechanical mold clamp.) The generalized construction of a machine affording complete range of die space adjustment from 0 to 36 inches is shown in Sketches No. 4 and 5. Due to the vastly increased weight of modern dies, the weight on the movable platen must have additional support. Since it is primarily the die and not the platen we aim to lift, the use of rollers operating on top of the upper tie bars seems a feasible method. The roller axle is connected by means af a vertical bar to any die, and the general construction of this feature is too simple to require illustration. Located above the die, the rollers are easily kept clean and score-free, and they may be loaded by the tie bolt or bolts so as to remove all sag from the die.

On the suggested machine the mold may be placed on the floor beneath the platens and lifted into place with one movement of a hoist. The mold need not be opened until after it is set in place and the support to the rollers installed. Perfect alignment is thus assured, and scoring of guide pins and bushings eliminated.

Since the adjustment for die height is accomplished by moving the stationary platen in relation to the movable platen, some adjustment for uneven dies or for off-center shots can still be made. This adjustment, however, will not throw off the factory-set alignment of the link mechanisms with the movable platen as can occur at present, where the link cylinder plate itself can be tipped by an uneven setting of the tie bar nuts. Thin or thick dies can thus be installed almost without limitation, and yet some differential adjustment of the four corners of the die is still possible by means of the nuts located behind the stationary platen.



SKETCH No. 4
Top view showing Maximum Die Space Adjustment and Long Heater

Several important basic variations of mold space adjustments are possible on the proposed empirical design. First the conventional adjustment can still be used, where the link mechanism and link cylinder

(Please turn to Page 11)

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Empirical Factors in Injection Machine Design

(Continued from Page 9)

support plate (a unit) is made movable, or else a new adjustment can be devised where the link cylinder plate assembly and movable platen are fixed, and molds are accommodated by moving the stationary platen AND the entire heater assembly to the right or the left as the height of the mold shall determine. On smaller machines, the tie bars may be fastened to the link cylinder plate, and both the plate and the tie bars themselves can be moved for die space adjustment. These adjustments and combinations of adjustments which are original with the writer result from a basic analysis of injection machine functions as interpreted on an empirical basis, and their value has already been profitably proven on a practical level.

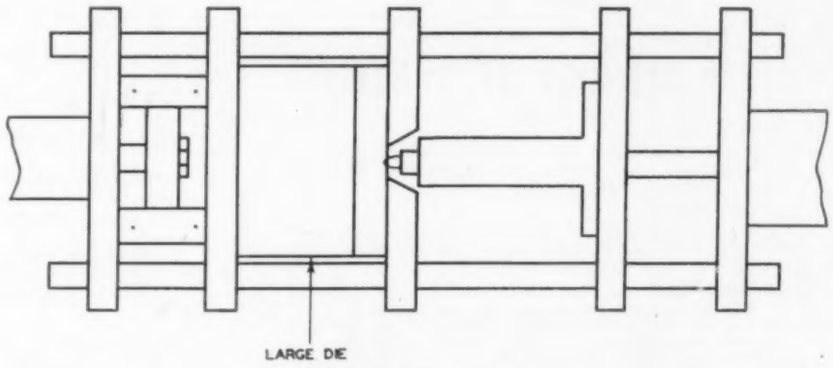
After the die is set, the heater is readily adjusted by moving its housing into position and fixing it on the tie bars with its locating nuts. The injection cylinder support plate is then set so as to permit the plunger to displace just enough material to fill the given mold. The entire set up job can be quickly and easily accomplished.

7. HYDRAULIC SYSTEM

A compact power unit of 2,000 lbs. line pressure, using a vane type pump and commercial valves is indicated in future machines. Such a unit can be engineered by hydraulic specialists, and obtained at a lower cost than the separate parts can be assembled and then built into a machine. Responsibility for the performance of the hydraulic unit can thus be fixed, and better service obtained. The oil tank and oil cooler are then made integral with the hydraulic system. Larger tanks and larger coolers are both indicated, as well as a change in general design in the location of the cooler. Instead of passing unused oil through the cooler as at present, where the faster the machine cycle the less oil is cooled, used oil should be cooled by passing all valve discharge lines into a common tube leading through a cooler. This is in line with the faster cycles observed today, and will do much to eliminate over-heating and excess water consumption criticized by molders everywhere.

The indicated hydraulic system need not be discussed in detail since its components are common knowledge. Accessibility of all parts for ready service is essential. Use of flexible hoses to connect the system to the machine is suggested for ease of maintenance, elimination of costly telescope tube designs, and especially to permit the full range of adjustments possible in this machine. A typical layout along this general line is given in Sketch No. 6.

Plunger speed is now of equal if not greater importance to the molder than plunger pressure, especially with a longer heater as suggested here. If the material does not completely fill the mold before it begins to set up or harden, no amount of pressure will ever compensate for lack of injection speed during die filling time. Present liquid-solid materials with abrupt melting points only accentuate this need for injection speed (at maximum pressure if this should be required). A study of modern thermoplastics with particular emphasis on the graphs of their melting points, will indicate that future plunger speeds may even begin to approach die cast machine plunger speeds. Elaboration of the nature of new high melting point thermoplastics is beyond the scope of this paper, but the fact is especially pertinent to future injection machine design.



SKETCH No. 5
Top view showing Minimum Die Space Adjustment

A conventional method of obtaining BOTH speed and pressure during the injection cycle is indicated, using vane type pumps. This need not be detailed here except to state that both the large and small vol ume pumps are caused to discharge at full pressure into the injection cylinder. An economical selection of pump and motor is thus permitted, and consequent savings in electrical current costs alone make the adoption of this system imperative.

8. GUARDS AND SAFETY DEVICES

To keep costs down, streamlining and non-functional work like casting filling, finish machining, and burnishing of mere "appearance parts" can be kept to a minimum. This machine must appeal because of its low maintenance costs. its high speed and productive ability, and its low current consumption, and not because of external, non-functional design features and smooth "tin" covers which unusued now litter the lofts of molding shops all over the country. Low first cost is of course of increasing importance as the prices of present machines continue to mount.

Properly trained sales and service engineers can easily overcome management objections to what could perhaps be regarded as a fairly crude appearing piece of equipment. We look to the nearby day when ALL steel must go to some functional use, and NOT into industrial designers' concepts of mere good looks.

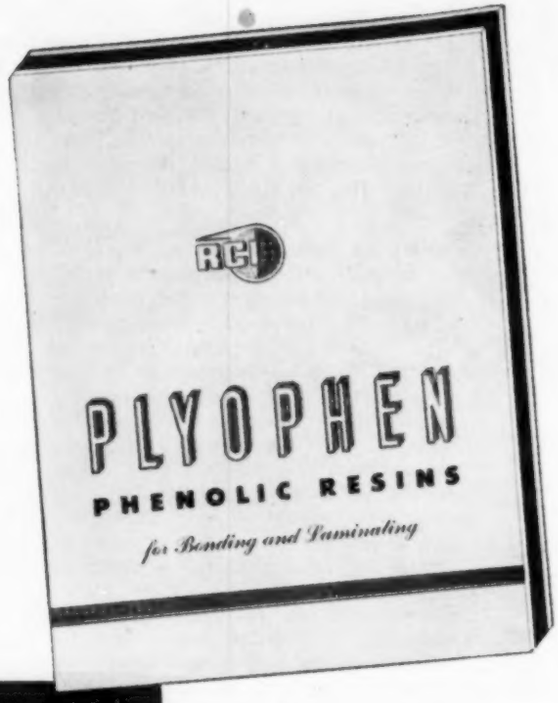
The legal aspect of omission of "tin" guards and covers can be met by a satisfactorily designed safety gate. The safety may even consist of an electronic screen to obviate the need for mechanical action of the gate, but it must operate independently of conventional controls. The advantage of the roller bearing mounted gate is that it protects against flashing or actual squirting out of the material which can happen accidentally, especially at die set up time with the newer semi-liquid plastics.

Automatic lubrication of all tog gles and moving parts is now simply and inexpensively done, and this feature should be incorporated.

9. MOLD FACTORS INFLUENCING INJECTION MACHINE DESIGN

Definitely related to ascertaining what constitutes an ideal injection machine are the size and shape of present and probable molds. Space between tie bars should not be less than 30 x 30 inches. The basic machine design suggested is such as to permit this space to be enlarged to 36x36 or even 40x40 as future needs require without major revisions in basic machine construction.

(Please turn to Page 13)



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Empirical Factors in Injection Machine Design

(Continued from Page 11)

Minimum and maximum die space ceases to be a problem when the suggested method or methods of die space adjustment are used, where the stationary platen is made adjustable in relation to the movable platen.

The movable platen should have a stroke of at least 20 inches. This stroke or travel will permit deep parts to be molded, and yet the stroke can be made adjustable by means of a stop screw projecting through the cylinder head, as in the case of the injection piston. This inexpensive feature will save cycle time, and permit ready adjustment of knockout travel.

Center and side knockouts should both be provided. Use of two or four knockout points will greatly simplify design of knockout plate assembly in the mold itself. Off-center knockouts can thus be used without expensive knockout bushing and guide assemblies in the mold proper.

Sprues should have a taper of 4-5°, and an effort should be made with all materials except acetate, butyrate, ethylcellulose and the acrylics to reduce sprue, runner and gate size to a minimum to accord with increased flowability of newer plastics. This will permit faster cycles in many cases by molding to the maximum thickness of the part instead of to a heavy sprue which must then be allowed to set before it can be pulled, although the part itself has become hard many seconds previously. Large nozzle opening size is of decreasing importance with newer materials, permitting the larger taper suggested without impinging on the seal between nozzle and sprue bushing. To accord with present standards and to avoid peaning, nozzles should have a ¾" radius. This will provide a seal in the event a large orifice must be used.

Furthermore recent experience dictates that all molds must be relieved as much as .020" around the cavities so as to concentrate the clamping action on the edge of the cavity, and not distribute it over the whole face of the die. Crowning of cavities to within ⅛" of the lip with a .005 crown also aids in securing maximum efficiency from the die clamp mechanism which will here approximate 500 tons.

Mold area or projected area can easily exceed 250 sq. in. in a machine with a clamp of approximately 500 tons, provided the material is fully plasticified in a long heater, and that the principles of lip-loading of the mold cavities described above are followed. To provide a clamp over 500 tons, structural members become so large that any economy of design as is being suggested here becomes largely impossible. We therefore have to compensate for this limitation by insisting on ample rigidity and massiveness in the mold itself, as well as by control over process factors such as plunger speed, heater temperature, and mold temperature. (Note that reference to the cycle or time element is now omitted, since that will be determined by the molded part and not by the limitations of the machine as is now all too often the case.)

And finally mold temperatures must be CONTROLLED. This will require a vast refinement over present practice where a hose is hooked into the die, and if the discharge water is felt to be warm, it is assumed that control is adequate. Die temperature must be held to within 1 degree over the entire face of the die. This can be accomplished by using a large volume of water, and arranging dual inlets and outlets to enlarged cooling passages. Such a control unit is now in the final stages of development.

10. FUTURE INJECTION PRESURES AND FUTURE MATERIALS

It may be observed that effective injection pressures of 20,000 PSI or slightly over (up to 25,000 PSI) are now required for most polystyrene molding. The vinyls, polyethylene, and nylon often require much less pressure, but a very close control of plunger speed. The acrylics alone require pressures approximating 35,000 PSI, with speed of plunger of lesser importance because heavy gates are universally used. Acrylic molding, however, seldom requires clamping of large area parts, confining itself to relatively thick sections and long cycles. The suggested design is adapted without any limitations to this specialized field for the length and diameter of both heater and injection cylinder can be readily changed with minimum expense and minimum conflict with other design features.

In recent months it has become apparent that long life and lasting appearance are molded into thermoplastics. Strains, loss of lustre, warping, crazing, and cracking all result from overheating and poor fusion of material in present limited heaters where a super-heat is used. Cooling fixtures to prevent post-

(Please turn to Page 25)

MIDWEST ELECTS

The Upper Midwest Section met December 13th, in the Coffman Union building of the University of Minnesota, to elect officers and a board of directors. Men elected were; PRESIDENT, Jerome L. Formo, Minneapolis-Honeywell Regulator Co.; VICE-PRESIDENT, Erwin W. Ulrich, Minnesota Mining and Mfg. Co.; SECRETARY - TREASURER, Laurence E. Erickson, Commercial Plastics. Elected to the board of directors were H. Hove, General Mills; S. K. Moxness, Minneapolis - Honeywell; J. H. Thomas, Minn. Plastics Corp.; E. W. Anderson, Minneapolis Plastic Molders, Inc., Dr. Fulton Holtby, University of Minnesota; T. Ingersoll, Plastics, Inc.; Paul Felt, Brown and Bigelow; J. H. Kugler, Minneapolis Mining and Mfg. Co.; and S. Sultany, Telex, Inc.

After the organization meeting, the film "The Scientific Approach to Better Plastics" was shown. The section plans to hold their meetings on the second Monday of each month, at the Coffman Union building of the University of Minnesota.

R. I. and MASS. OFFICERS

Officers and Directors elected at the last meeting of the Rhode Island and Southeastern Massechusetts section were; PRESIDENT, Richard H. Bruce, Bakelite Corp.; SECRETARY, Michael M. Suba, Bakelite Corp.; TREASURER, C. J. Cowan, Cowan-Boyden Corp. Directors to serve through 1951 are C. J. Cowan, William Fitzgerald, and M. M. Suba; directors to serve through 1950 are Richard H. Bruce, F. V. Murphy, and J. Douglas Kirk; directors to serve through 1949 are Arthur Richardson, Rudolph Jacobs, and A. H. Angell.

PHILLY ELECTION HELD

The Philadelphia section, 1949 hosts to the National SPE Technical Conference, has announced the result of elections for officers of the section. PRESIDENT, A. D. Calabro; VICE-PRESIDENT, Meyer Sperber; SECRETARY, H. S. Stevenson; TREASURER, Harry J. Harp, Jr. The board of directors now consists of G. H. Mains, H. B. Haley, Meyer Sperber, C. W. Gayler, W. O. Bracken, and George Elmendorf.

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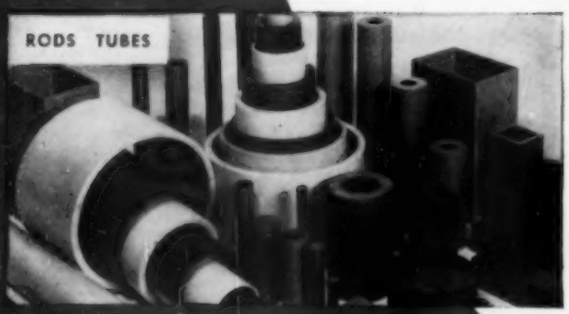

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(Send for further literature)

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Wednesday, January 19th, 1949

9:00—OPENING REMARKS

9:10

FLAME-RESISTANT CELLULOSE ACETATE MOLDING MATERIALS

Burton E. Cash

Celanese Corp. of America

The extensive development work done in producing a series of **Lumarith XF** formulations to give them low flammability without sacrificing other desirable properties of cellulose acetate molding compounds, will be described in detail. Incorporating certain plasticizers and modifiers, the first formulations yielded injection molded parts having improved gloss, a high order of surface hardness, good dimensional stability and heat resistance as well as low flammability.

They were, however, limited to dark translucent and opaque colors, and in some of these it was difficult to maintain color uniformity. How these disadvantages were overcome by further research, with the use of an improved acetate flake, leading to new formulations which have been used for several commercial products requiring the Underwriters Laboratory approval, will be disclosed in this paper.

9:45

EFFECT OF COMPOSITION AND COMPOUNDING ON PROCESSING AND PHYSICAL PROPERTIES OF RIGID VINYLS

G. E. Field

B. F. Goodrich Chemical Co.

The paper covers the effect of variations in composition on the softening points and plasticities of Geon rigid vinyls. The effect of plasticizers on these properties will also be included. The relationship between plasticity and processing temperatures as well as a rapid method of determining optimum processing temperatures will be discussed.

Slides will be shown illustrating graphically the effects on softening points and viscosities caused by variations in plasticizer content. The composition of the compounds studied has been varied sufficiently to cover quite a range of initial hardness values.

A brief discussion of testing methods used will be included.

10:15

TUFLITE

Harold S. Sell

Goodyear Tire & Rubber Co.

The development of blends of high styrene **Pliolite S6** resin with various rubber-like polymers to produce a family of compounds, known as **Tuflite** compounds, has brought more closely together the fields of rubber and plastics. Blends of the hard rigid styrene resin with the characteristics soft rubber have produced materials with many unique properties, available in wide color range. Among these properties are: (1) excellent impact strength combined with rigidity, (2) the ability to absorb loading and produce stocks in a wide range of specific gravity, (3) ease of molding, (4) machinability on wood or metal working equipment, and (5) post-form ability.

These properties and the possibilities of 'tailor-making" a **Tuflite** compound to meet a desired requirement will be discussed in this paper.

10:45

HIGH POLYMERIC TRIFLUORO-CHLOROETHYLENES

Louis C. Rubin

M. W. Kellogg Company

These interesting new materials were developed during the war for the Manhattan District, and are now being produced by the M. W. Kellog Company under the trade names KEL-F and KEL-FLO. Their properties, fabricating techniques and uses will be discussed.

High polymeric trifluorochloroethylene (KEL-F) is a chemically inert thermoplastic which can be molded by conventional methods at from 250° to 300° C. It is insoluble in common organic solvents, is swollen at elevated temperatures by halogenated solvents. It is inert to aqueous acids, bases and oxidizing agents. Its electrical losses are low, and specific resistance is high.

Trifluorochloroethylene polymers in the 1000-2000 range of molecular weight (designated KEL-FLO) are oils or waxes. They exhibit the same chemical inertness of KEL-F, and have some lubricating properties. They can be used as plasticizers for KEL-F.

11:45

ALKYD HOT MOLDING COMPOUND

M. H. Bigelow

Plaskon Div., Libbey-Owens-Ford

A new thermosetting industry molding compound, based on a polyester type resin, is designated as Plaskon alkyd molding compound, and represents the first use of such a resin in materials for hot molding.

The new alkyd molding compound embodies several features which make it attractive to molders seeking high-speed production procedures. The compound is extremely fast curing and requires relatively low pressures for molding. It permits the use of less massive, less expensive, but fast-closing equipment. The material molds with surprising ease in equipment operated by air pressure, thus eliminating the need for high-pressure hydraulic systems and heavy-duty accumulators.

While in the plastic state during molding, very little pressure is required to flow the material over the mold surfaces. The press must be fast enough to drive the mold parts completely together during the first 2 seconds after the material has reached mold temperature. In most cases 300° to 310° F. is the optimum operating range.

The paper will discuss physical properties, especially dimensional stability, strength, heat resistance, electrical properties, and resistance to chemicals. Molding procedures and mold design will also be described.

Wednesday Afternoon, Jan 19

2:00

PROTECTIVE FILMS FROM S-POLYMERS

Raymond G. Newberg

Standard Oil Development Co.

S-Polymers, a new series of hydrocarbon thermoplastic copolymers, are produced by low temperature polymerization techniques from styrene and isobutylene. They have good electrical and physical properties, easy processability, and excellent resistance to the penetration of moisture and gases.

Among a variety of applications which have been investigated, the most interesting appear to be in the field of packaging where the resins' resistance to gas and moisture vapor penetration is very advantageous. Results from a series of tests show that thin films of these transparent plastics very effectively prolong the storage life and minimize the shriveling of fresh fruit. Fresh fruits wrapped in films of S-50 Polymers showed very little if any loss in appearance, food value or edibility after twenty-eight weeks, and lost only slightly over ten percent of their original weight. Unprotected fruits were shown by controlled experiments to be relatively inedible in two weeks.

Other applications for S-Polymers include electrical insulation, cast films, modifying agents and processing aids for rubbers and resins, capsules for aqueous and alcoholic solutions, laminates, recording material, and wax modifiers for wax coatings.

2:25

R. M. PAULSEN
U. S. Rubber Co.

SATUSPLY—A new Plastic Resurfacing Material

2:50

PLASTICIZERS

J. Kenneth Craver
Monsanto Chemical Co.

The importance of plasticizers in the field of plastic moldings, elastomeric extrusions and films and surface coatings has increased phenomenally with the growth of these industries.

The evaluation of plasticizers has in the past been on a purely empirical basis, but a review of recent work reveals that a point has been approached where some predictions can be made as to the compatibility and efficiency of a plasticizer in a new system.

The importance of plasticizer compatibility, efficiency and permanence will be discussed, together with volatility, food tolerance, flammability, weathering, low temperature flexibility and availability. Some types of plasticizers most useful with various commercial synthetic resins will be outlined and samples of plasticized compositions will be displayed. New types of plasticizers will be described and the steps by which these were developed will be outlined.

3:40

PLASTICS EDUCATION AND RESEARCH AT PRINCETON

Louis F. Rahm
Princeton University

The educational objectives of the plastics program at Princeton are instruction and research in the application, processing, fabrication and basic properties of high polymers as engineering materials.

At the undergraduate level, introductory class and laboratory work provides fundamental training. There is a growing demand for the four year engineering Bachelor graduate in the general manufacturing industries. A graduate program of instruction and research is offered to supply the needs of the plastics industry for specialized engineering talent. The curriculum integrates a number of essential graduate courses into a well rounded plan of instruction in plastics leading to a Masters Degree in Engineering.

The research program, sponsored by the Army Signal Corps and various Navy Bureaus, represents unsolved plastics problems accumulated during the war. Some of the studies in progress are: Arc Resistance, Arc Resistant Laminates, High K-Low Loss Materials, Potting Compounds, Rheological Studies, Microwave Measurements and Measurement Methods.

Thursday, January 20th, 1949

9:00

"PLASTIC FILMS IN QUARTERMASTER CORPS ITEMS"

W. A. Stubblebine
Office of the Quartermaster General

Summary: The present status of plastic film applications in items of military supply by the Quartermaster Corps will be discussed. Three basic phases of film applications are discussed, namely, clothing, packaging and protective covers. The discussion of the work on packaging materials will center on specific requirements for the many specific items to be packaged. The basic problems associated with the use of plastic films in items of clothing will be discussed and some of the difficulties encountered will be presented for further study. The use of films for equipment covers and the associated problems will be discussed.

A general review of other Quartermaster Corps research and development on plastic film will be presented.

9:40

NEW TESTING PROCEDURES BEING DEVELOPED FOR PLASTICS

Albert G. H. Dietz
Massachusetts Institute of Technology

Dr. Dietz's talk will be largely devoted to showing a technicolor sound movie describing the fundamental work in the basic mechanical properties of plastics being carried on under the P.M.M.A. program at the Massachusetts Institute of Technology. The movie was made by the Society of Plastics Industry so that information regarding the work would be more widely available. The program has entailed the development of methods of test and the development of testing equipment to make possible fundamental analyses of the strength properties of plastics. It is directed toward determining the validity of some of the theories respecting the plastic, nonelastic, behavior of materials as they may relate to plastics.

10:10

STYLING MOLDED PLASTICS

Donald W. Biklen
Debell and Richardson

A product is said to be well designed when it has been reduced to its utmost simplification in terms of function and form. A good mold design never comes by chance, nor does a good product design — both are the products of a trained intellect.

Proportion, balance, rhythm, emphasis, harmony, variety, texture and color are the fundamentals of design, with which the plastic engineer should acquaint himself. Good product design should go hand in hand with good mold design. The products of the design-conscious molder get more than their share of the potential market.

10:45

SILICONES AS MOLD RELEASE AGENTS

W. A. Wiard
Dow Corning Corp.

After a brief discussion of the history, chemistry and basic properties of the various forms of silicones, together with their principal applications, three silicone materials widely used as mold release agents will be described and evaluated. These are a silicone fluid, an emulsion and a grease-like compound. Most mold lubricants either contaminate the product or break down at molding temperatures, leaving a carbonaceous deposit which necessitates frequent and costly cleaning of molds. It will be pointed out that the silicones' high heat stability (which makes them resist oxidation), their relative inertness and incompatibility with organic material, and their lubricity bring them closer to the specifications of an ideal mold lubricant.

11:10

SPE PRIZE PAPERS

Thursday Afternoon, Jan. 20

1:00—LUNCHEON

2:00—BUSINESS MEETING

Friday, January 21st, 1949

9:00

SURFACE FINISHING OF DIE MOLDS

Roger F. Waindle

Elgin National Watch Co.

This paper, profusely illustrated with specially prepared slides, will describe the various methods developed by the watch industry for economically obtaining better surface finishes. Particular emphasis will be laid on machine parts, tools, dies and molds. An analysis of these finishes and their measurement, and the advantages of higher finishes, will be fully discussed. Divided into three parts, the paper will first explain the "what" of finishes—their language and measurement methods; then the "why"—the increased wear resistance, lower friction and superiority of parts produced from higher finished machine components and molds; and finally the "how" of finishes, which will include a discussion of their economics, machining methods and a complete demonstration of the new diamond abrasives used for producing higher finishes more economically.

9:50

STEELS FOR MOLDS AND HOBS FOR THE PLASTICS INDUSTRY

Peter Payson

Crucible Steel Co. of America

Steels are far from simple either in composition or in their response to heat treatment. Because of this, some steels are soft and plastic enough to be shaped into molds readily at room temperature in conventional presses, whereas other steels are hard and tough enough to serve as the hobs which form the impression in the steels that are used for molds. This paper is a concise presentation of the kinds of steel in use to-day; the reasons for the wide variety that exists; the basic principles that govern the heat treatment of steel; specific description of the steels used for molds and hobs in the plastic industry; and the heat treatments of these steels.

10:20

PLASTICS MOLDING

Adolphe J. DeMatteo

Watson-Stillman Co.

Despite the antiquity of the hydraulic press, tremendous improvements have been made to give the machine its many modern refinements and its present day flexibility. Many of these improvements have come about under the impetus of demand for better machinery in metal forming and plastics molding. In plastics molding the most important draulic press are its design, selection and maintenance. An understanding of some of the principles of design is important to both the selection and maintenance of machinery.

Commencing with definitions of the principal technical terms, the paper demonstrates the basic law of the hydraulic press and its extension to modern machinery used in plastics production. The application of these principles to the selection of machinery for specific production jobs is discussed, together with some important points in the care and maintenance of hydraulic machinery.

11:10

THE TROUBLE SHOOTING OF MOLDING PROBLEMS

Frank J. Donohue

Monsanto Chemical Co.

Molding problems, however unique and unusual they seem to be, usually arise from the interplay of four related factors: the plastic material, the part design, the mold design and the molding conditions.

If part design and mold design are correct (an assumption that cannot always safely be made), the problem is caused by variation in the material or in the molding conditions. The process of solving such a problem then becomes a deductive one in which the various possible causes are catalogued and eliminated by careful testing until, if the trouble shooter is sufficiently persistent, analytical and lucky, and the customer sufficiently patient, the true cause or causes are determined.

In this paper, the most frequently encountered molding problems and their systems are described, the possible causes listed and the remedies indicated.

The difference between mere academic solutions and practical remedies which can be applied in a commercial molding plant, is pointed out. The work necessary to solve these problems may often have to be done under difficulties and the stress of production.

Friday Afternoon, Jan. 21

2:00

PLASTIC FILMS

Milo R. Gerow

Reynolds Metals Co.

This paper will review plastic films in packaging of industrial and consumer items, will indicate the size of various markets, and show trends which are to be expected as newer materials become available.

The various methods of production of film, and of combining it with metal foil, paper and cloth will be discussed. It will be shown that the choice of plastic film is frequently dictated by processing factors in making the package, and that the successful producer of film must keep in mind the problems of the convertor.

2:40

"POLYETHYLENE PERMEABILITY DATA AND THEIR PRACTICAL USE"

James H. Parliman

Plax Corp.

Much costly and time consuming testing of polyethylene for packaging applications can often be eliminated if sufficient attention is given to available permeability data.

This paper reviews the simple bag method for obtaining approximate permeability rates, theoretical considerations, method for predicting permeability rates from other known data, effect of temperature and effect of liquid and gas phases.

New data are presented on the permeability rates of various liquids through polyethylene, including several inorganic acids, organic materials and various commercially marketed products. The permeation of hydrogen peroxide under both light and dark conditions and change of concentration of ammonium hydroxide are discussed.

Other examples of practical applications of permeability data in packaging problems, including permeability analyses of the components of several liquid cosmetics, are given, along with a discussion of the general problem of evaluation of permeability data for mixtures.

3:15

TRENDS IN EXTRUSION MACHINERY

Albert A. Kaufman

Industrial Synthetics Corp.

In the extrusion section of the plastics industry there has been less agreement than in the injection and compression section as to what constitutes desirable equipment. This paper will provide an up-to-the-minute review of designs of extruders and control equipment.

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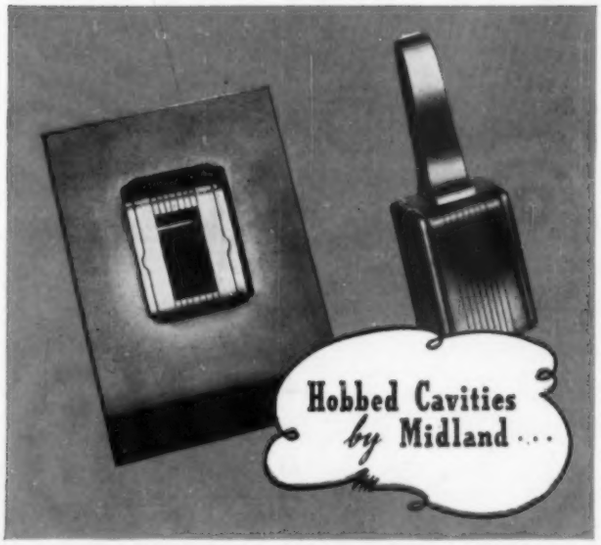

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NEWS OF NORTHWEST PENNSYLVANIA

By PAUL ROCHE

William R. Byrd, Proprietor of Byrd Tool and Mold Company, announces the construction of a new plant to house the expanding facilities at that company. This new plant will more than double the floor space of this company, whose business predominates in injection type molds built for the principal molding plants in the area. Bill Byrd is one of the most active supporters of the Northwestern Pennsylvania Section of the SPE.

Ervin L. Rader has recently transferred his association from Sylvania Electric Products Company, Warren, Pennsylvania, to G. G. Green Company of the same ctiy. Mr. Rader's experience in plastics goes back several years, having previously been connected with Warren Plastics in a supervisory capacity.

Election of Directors for 1949 is now under way in the Northwestern Pennsylvania Section. Mr. Robert Kling, Chief Mechanical Engineer, Erie Register Corporation, headed the Nominating Committee which turned in a very commendable slate, listing a representative list of candidates from the various companies, localities, and phases of plastics activities.

The Choristers of the Uthmann Chor, Erie, Pennsylvania, a choral singing group of approximately 40 voices, elected **Paul C. Roche** as their 1949 President in an annual business meeting on Monday, December 20, 1948. This amateur singing group includes a considerable amount of activity in their year's curriculum, having recently sung in Detroit at the Michigan State Fair.

SOUTH TEXAS ELECTS OFFICERS AND DIRECTORS

By WILLIS L. BARNES

At the annual business meeting of the South Texas Section of the Society of Plastics Engineers, held Dec. 15th, the following officers were elected for 1949:

PRESIDENT, Marion A. Arthur, Humble Oil & Refining Co., Houston, Tex., Director for 2 years; VICE-PRESIDENT, C. G. Harrison, Public Works Dept., City of Houston, Tex., Director for 1 year; SEC.-TREAS., Willis L. Barnes, H. L. Thompson Co., Esperson Bldg., Houston, Tex., Director for 2 years.

Directors elected for the local section include the above three men and also:

H. S. Henderson, Dow Chemical Co., Freeport, Tex., 3 years. J. A. Sinclair, McArdle Equipment Co., Houston, 3 years. Phil Shay, Reed Roller Bit Co., Houston, 3 years. D. E. Henderson, F. H. Maloney Co., Houston, 2• years. L. D. Bloxsom, Southwestern Plastics, Inc., Houston, 1 year.

Mr. Bloxsom was re-elected to the National Council and to the National Advisory Board. Mr. D. E. Henderson was elected to the National Advisory Board.

The South Texas Section was chartered in January, 1949, with 15 members. There are now 25 at the end of the first year. Meetings are held the third Wednesday of each month, except in the summer, and are open to the public.

South Texas committteems appointed for 1949 are:

PROGRAM, D. E. Henderson, Chmn.; D. E. Bloxsom, V. C. Henrich. HOUSE - PUBLICITY: W. L. Barnes, Chmn. N. McFadyen, H. L. Collins. MEMBERSHIP - CREDENTIALS, G. G. Harrison, Chmn., J. A. Sinclair, B. W. Wallin. ELECTION-NOMINATING, H. S. Henderson, Chmn., Perry Warmath, L. D. Harvey.

ROCHESTER

ROCHESTER section met December 14th, to hear L. W. A. Meyer of Tennessee Eastman talk on "Cellulose Ester Injection Molding and Extrusion Material."

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FINISHING SYMPOSIUM AT WESTERN NEW ENGLAND HAS THREE SPEAKERS

Sherwood Young Is New President

By G. W. MARTIN

The regular December meeting of the Western New England Section of the Society of Plastics Engineers was held at the Hotel Sheraton, Springfield, on the first.

G. W. Martin

The meeting was called to order at 8 o'clock by Mr. Frank Donahue, Section President. Mr. Donahue expressed his gratification of the large turnout of approximately 80 members and guests.

The program for the evening consisted of three speakers who were to discuss the finishing procedures used in their particular phases of the industry.

Mr. George Carlson had accepted the job of Master of Ceremonies, and went on to do an excellent job in that role, introducing first Mr. Jerry Heldrich, Factory Superintendent of Plax Corporation, whose subject was the Finishing of Sheets and Rods.

Plax finishing includes all types, from simple blankings to intricate machinings. Mr. Heldrich pointed out that due to the extreme resistance the styrene presents to machining operations, it is necessary to apply considerable attention to the methods of sharpening the tools. Two very important factors also are; first to strive to pull the shavings or chips away as quickly as possible, and second, to keep the surface cool. Air, water, or lard will act as excellent coolants, air preferably, due to its action of blowing away chips at the same time. Drills are usually fluted and cored so that the coolant can be forced through the drill and back up the sides pushing the chips up and out.

Ordinary tool steel is usually good enough for tools on a short run job, Carboloy tools for a medium run job, and diamond tools are recommended for really long run jobs.

The speaker recommended that in any case it is advisable to heat-treat, or anneal, sheets and forms to be machined due to the internal strains that are set up. To do this he recommends throwing them into a tank at 165°F. for ½ hour, both before and after machining.

Mr. Heldrich then went on to blanking and punching of styrene sheets. He stated that thin gauge sheets will punch as readily as thin gauge sheet metal. They normally punch up to ⅛" thick on standard dies; going as high as ½" to ⅜" thick with special tools. They can punch as many as three to four hundred per minute, without using a coolant.

Cellulose derivatives should, however, be cooled when punched due to a gumming action of the resins. Cast acrylics should also be lubricated, while extruded acrylics do not require lubrication.

On the subject of polishing, he explained that acetates, butyrates, and ethyl cellulose will polish easily by buffing and tumbling. Methacrylate and styrene will tumble polish when using a glycerine but not a turkey red, or other oil that will attack styrene. water soluble waxes are excellent for styrene. Nylons, etc., are not suitable for tumble polishing. A buff is recommended; the first to

(Please turn to Page 23)

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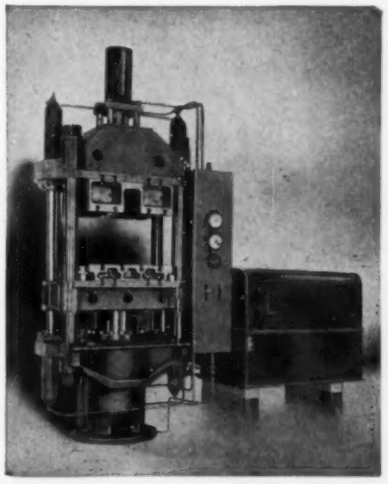

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Martin Marvinol

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Finishing Symposium

(Continued from Page 21)

cut slightly and the second to wax polish. Similar equipment to centerless grinders are sometimes used for buffing rods, etc. Wheels up to 12" wide are used on square, and rectangular shapes.

For burrs on styrene, tumbling in pegs and sawdust at 75 to 80 cycles per minute achieves excellent results. A faster tumble usually generates too much heat.

Mr. Carlson then introduced the second speaker, Mr. Sherwood Young, V. Pres. and General Manager of C. F. Church Mfg. Co.

Mr. Young gave a very enlightening talk on the finishing of injection parts, confining most of his time to the specific finishing of the Church toilet seat. This seat is sanded over 100% of its surface, and is then buffed to a high polish. Mr. Young was assisted in this description by his finishing dept. foreman, who demonstrated the actual motions gone through by the men while buffing. This particular phase proved very interesting and also very humorous, because, as the foreman put it, the motions greatly resemble those of a hula-hula dancer. They stated that when they first started sanding the seats, they used a wet belt and average 700 to 800 seats per belt. During the sanding operation, streams of water at 120 lbs. pressure, are directed on the belt. This keeps the belt from packing up. They do, however, still use dry belts on the hard rubber applications keeping the grits very fine.

Several samples of polishing compounds were shown, bringing out the same point that was mentioned by the previous speaker; that a compound of a cutting nature is first used and then a compound of a polishing nature. Combined with a specially prepared compound that is applied directly to the seat, the result is a mirror like finish without the slightest trace of a sanding mark. These gentlemen also displayed one of their giant buffing wheels along with several seats, which showed the various steps of finishing.

The third speaker of the evening was Mr. Carlson's own finishing superintendent, Mr. Frank Scanlon, of Arrow-Hart and Hegeman, whose subject was the finishing of phenolics.

A good part of the talk was devoted to actual demonstration, for which Mr. Scanlon had provided himself with an excellent array of finishing fixtures. A very interesting feature was the demonstrating of several punching fixtures which were built from standard bottle-cappers. According to Mr. Scanlon, they have several hundred of these cappers at their plant. The purpose is to have a fixture for each cleaning operation. When a cleaning punch and die is made it is fitted immediately to a capper, so that when it leaves the toolroom it is, in itself, a complete fixture.

As an operator must change operations several times a day, this unique system saves untold hours of set-up time. The operator needs only to reach for a new fixture and adjust the clamping screw to the bench. Die changing is completely eliminated. Mr. Carlson later pointed out that the initial cost of these cappers was only about $2.50 each.

The speaker was well supplied with samples, with which he briefly discussed the various types of cleaning punches and fixtures that were used.

The president called on Ed Vaille, Section Secretary, to give a brief report on membership. Ed stated that in November, 1947, the members numbered 42, with a guest mailing list of 40. At present the members number 75, with a guest mailing list of 121. These figures are clear indications of the live-wire, progressive nature of the Western New England Section. The Section treasurer, Jack Bitter, presented his report which also proved the extremely healthy condition of the Section.

The new Section officers and directors were introduced as follows:

President, Sherwood Young, Church Mfg. Co.: V. President, George Whitehead, Improved Paper Mach. Corp.; Secretary, Ed. Vaille, Bakelite Corp.; Treasurer, Dr. J. Brown, Pro-Phy-Lac-Tic Brush; New Directors, Robert Crawford, Monsanto Chem.; W. Noble, Morart Gravure Corp.; Incumbent Directors, M. J. Petretti, Noma Electric Corp.; F. J. Donahue, Monsanto Chem.; Jack Bitter, Parker Stamp Works.

The following members were appointed as committee chairmen:

Membership, F. J. Donahue; Credentials, H. H. Hasenzahl; Program, M. J. Petretti; Publicity, W. Noble; House, R. W. Crawford.

RESEARCH POTENTIAL FOR PLASTICS MANUFACTURING IS TOPIC AT NEW ORLEANS

New Orleans section was host in December to H. A. Busby, of the Southern Regional Research Laboratories of New Orleans, who talked on "Research Potential for Plastics Manufacturing". Highlights of his address include salient factors about the plastics industry which are known, but not recognized by the members of the plastics industry as necessary for the welfare of the industry.

He stated that the potential for greater expansion of the industry is closely related to coordinated refinement of techniques of application, together with development of special-use chemical constituents such as plasticizers, solvents, extenders and so on. Figures on consumption of resin-based types furnish indications of the market-acceptable plastics. New developments have followed closely on such research findings as: manufacturing refinement of intangible possibilities in processing, and effort for new market penetration.

Appraisal of comparative values of plastics in use discloses the necessity of new type testing techniques, built around precise measurements of innate physiochemical properties and rheological concepts. Greatest potential of expansion of the industry has been built around unprecedented manufacturing development of new plasticizers, solvents, extenders, fillers and short-molding-time resins, and in particular, silicones.

Officers elected for the New Orleans section for 1949 are, PRESIDENT, Leon Godchauz, II; VICE-PRESIDENT, Ralph F. Chambers; SECRETARY-TREASURER, Frank Perschall; National councilman, H. A. Levey. Also elected to the board of directors are H. A. Busby and Sam Harris.

WINNERS

(from page 1)

printed, we do not have at hand the titles of the winning papers, but in the next issue we will bring full information on the winners, and we hope to publish all of their papers.

The distinguished judges of the contest were G. W. Clark, Chief of the Plastics Division of the Owens-Illinois Glass Co., at Toledo, Ohio; Frank Carman, general manager of Plastics Materials Manufacturers Association; Nick Rakas, General Chairman of the Technical and Engineering Committee of S.P.I.; Robert Burns, in charge of plastics engineering at the Bell Telephone Laboratories; Garson Meyer, in charge of the chemical, metallurgical and plastics laboratories in the Camera Works division of Eastman Kodak Co.

plas'tic (plas'tik), a. [L. plasticus, Gr. πλαστικός. 1. Formative; as, "plastic Nature." 2. Pert. or appropriate to, characteristic of, or produced by, molding or modeling; — said of sculpture, ceramics, etc.; as, the plastic arts. 3. Capable of being molded or modeled, as clay; hence, impressionable; as, a plastic youth.
plastic operation, an operation in plastic surgery.—
, surgery, surgery concerned with the

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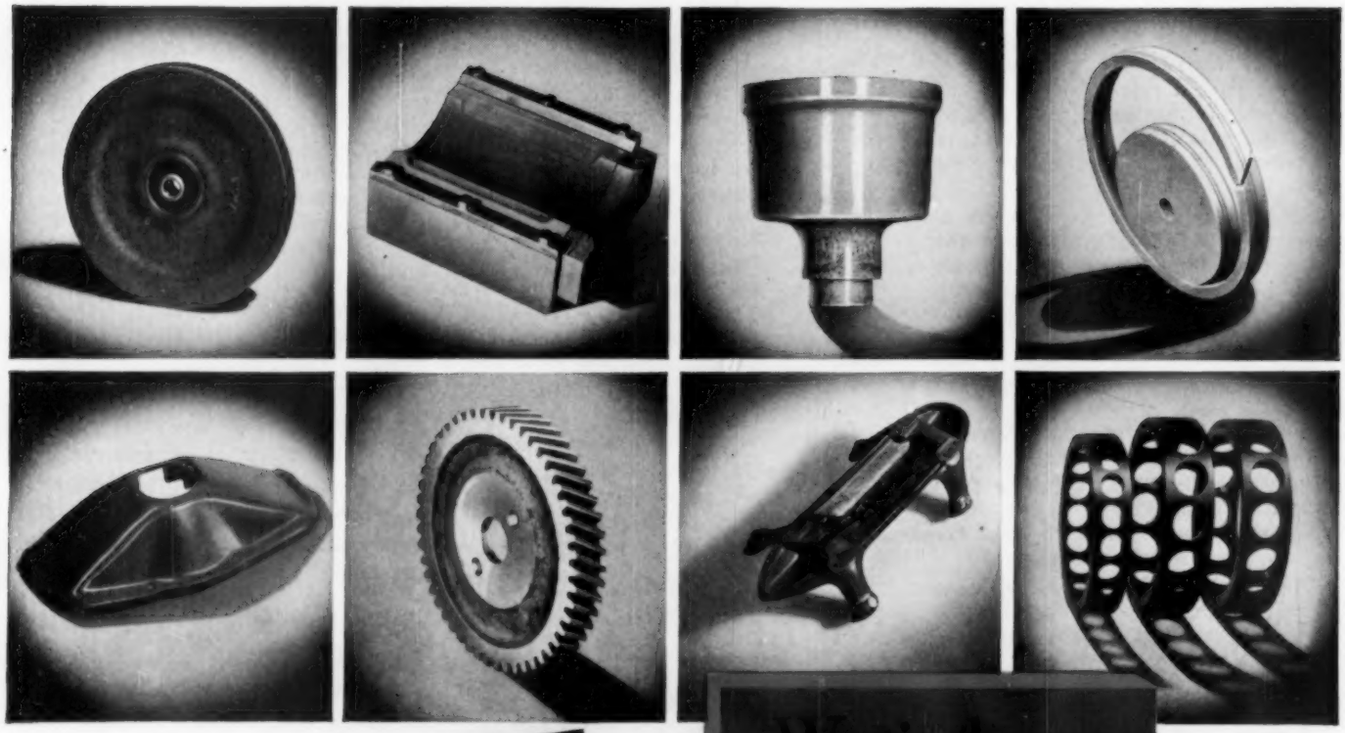

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Empirical Factors in Injection Machine Design

(Continued from Page 13)

molding warpage are an almost sure sign that the part user may expect long - term warpage. Molded - in strains soon enough recur as eventual warpage, a fact most refrigerator manufacturers will be learning in the next year or so. The only way to eliminate brittleness, discoloration. and long term warpage is through proper plastifying. At present because of heater length limitations, this unfortunately means use of a longer cycle. But price and competitive factors are already beginning to show that this problem is not properly a molding one, but one that belongs in the province of machine design.

For that reason, since every piece of empirical evidence points to the need for a longer heater, this paper has been prepared around the design of a machine which will readily incorporate this essential feature.

CONCLUSION

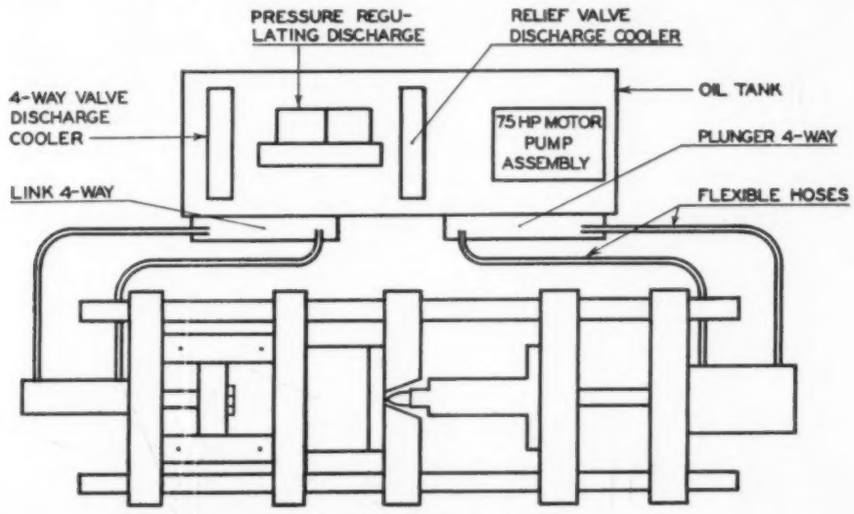
There are a host of ingenious mechanisms which might be considered in relation to injection machine design, but which have dubious commercial value in the near future. This paper, therefore, has been limited to suggestions which can be readily assimilated, and which will have immediate benefits for molders already part-pressed to adapt present machines to the specialized materials and molding problems now appearing.

It has been my aim to show that it is possible, even in the face of rising costs, to design and build a large capacity injection machine of approximately 24 ounce plastifying capacity in polystyrene (eg. capable of shooting 24 ounces of polystyrene at the maximum indicated machine cycle of about 25 seconds). The machine should incorporate a very minimum 400 ton mold clamp with 500 tons preferred. It should be built, sold and serviced for under $20,000, apportioned about as follows: $5,000 to purchase of completed parts; $5,000 to purchase of components; $5,000 for machining and assembly of components; and $5,000 for sales, service and profits. All sales and service should be direct.

The desired machine can be achieved by incorporating a bar type toggle machine, using a separate pump unit with a functional design which permits installing a heater of any required length. Molds of any height can be accommodated. A heater of at least 5 feet in length of simplified design is indicated, although no reason except inexperience with possible difficulties of purging can be advanced to show why this heater cannot be 6 or 7 feet long with even better results, provided of course that basic machine design is as flexible as the suggested one.

An increased number of pyrometer controllers up to as many as 6 is suggested, plus cooling of the heater. Increased plunger speeds approaching 150 in. per min. at full injection pressure (25,000 PSI over a 3½" dia. plunger) are also indicated.

Tentative specifications of the suggested machine are appended, along with a detailed bibliography, and sketches to illustrate in simple outline form some of the machine features which have been described above.



SKETCH No. 6
Floor plan to show separate Power Unit

INJECTION MACHINE DESIGN— A BIBLIOGRAPHY

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(Please turn to Page 26)

TENTATIVE SPECIFICATIONS FOR 24 OUNCE INJECTION MACHINE

Casting Area in mold	250 sq. in.
Minimum die space	0"
Maximum die space	36"
Movement of mold (stroke)	20" or less
Mold closing pressure	500 tons
Diameter of tie bars	6"
Space between bars	30" x 30"
Thickness of die plates	14"
Size of die plates	40" x 40"
Stroke of injection plunger	16" or less
Pressure on injection plunger	25,000 PSI
Diameter of injection plunger	3½"
Plasticizing capacity per hour	200 pounds
Capacity of feed hopper	200 pounds
Ounces of styrene molded per shot	24
Maximum cycle speed	25"
Motor required	75 HP
Type of Pump	Vane
Make of Pump	Ohio (special)
Delivery of Pump	80 GPM @ 2,000 PSI
Length, width, height	180" x 65" x 80"
Hydraulic unit	72" x 48" x 48"
Weight	21,500 lbs.

Standard Equipment: Motor, timers, pyrometers, water-cooler, 2 nozzles ⅜" and 7/16", wrenches. Machine to be ready for operation except for wiring of motor, piping of water-cooler, addition of hydraulic oil, and mold.

Empirical Factors in Injection Machine Design

(Continued from Page 25)

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(Please turn to Page 29)

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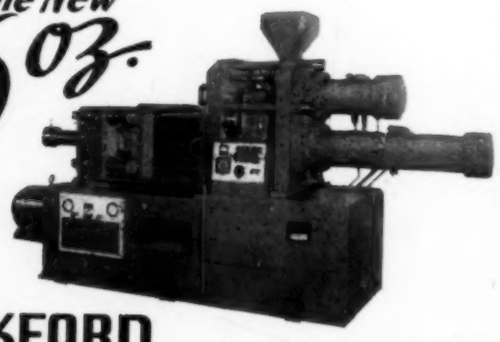
January 19-21, 1949.

The Spectrum Manufacturing Company, manufacturers of The Spectrum Corner Stayer, Bar Sealer, and Card Sealer, will also demonstrate a two corner attachment for their electronic corner stayer.

The New 16 oz.



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PLASTICS IN PACKAGING DISCUSSED AT NEW YORK

By ARTHUR M. MERRILL

Thirty-four members and guests of the New York Section attended a regular dinner meeting on December 14, at the Hotel Sheraton. Speaker of the evening was Carl Cobbledick, packaging director of Egmont Arens Associates, who discussed "Plastics in Packaging."

A. M. Merrill

Plastics will become more widely accepted as a packaging material, Mr. Cobbledick said. Manufacturers' resistance to plastic packages has been based on their higher unit cost, but such resistance is not justified in view of the greater sales appeal of the plastic package. Although higher unit costs prohibit use of plastics for every packaging application, the following factors justify consideration of plastics for any specific packaging problem: (1) possibility of increasing sales by converting a planned purchase item into an impulse purchase item; (2) building demand and brand loyalty by plastic containers having re-use value; (3) merchandising the line with matched-set containers which stimulate the purchaser to buy the whole line in order to complete the set; and (4) prestige and novelty of plastic packages where such qualities help sales. Mr. Cobbledick illustrated his talk with samples of plastic packages used to merchandise different types of products, giving case histories of increased sales following introduction of the plastic package. The speaker concluded by emphasizing that the plastic package is primarily a merchandising aid and only secondarily a container.

In the business session preceding the talk, section president Arthur Nufer, Bakelite Corp., announced the election of the following new directors: George Barron, Ideal Plastics Corp.; E. V. Walsh, Tech-Art Plastics Co.; and Bruce Wessinger, Wess Plastic Molds, Inc. Mr. Nufer also announced that the group will be the guests of the Newark Section at its next meeting on January 12, at the Newark Athletic Club. "Selecting the Right Plastic Materials" will be the subject of this meeting, and speakers will be Robert Burns, Bell Telephone Laboratories, and Emil Beekman, Army Signal Corps Laboratory, Ft. Monmouth. Table favors consisting of plastic puzzles with key chains were distributed through the courtesy of Mr. Wessinger.

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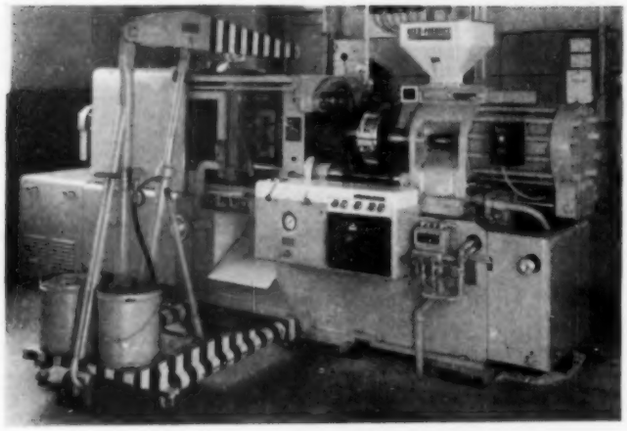
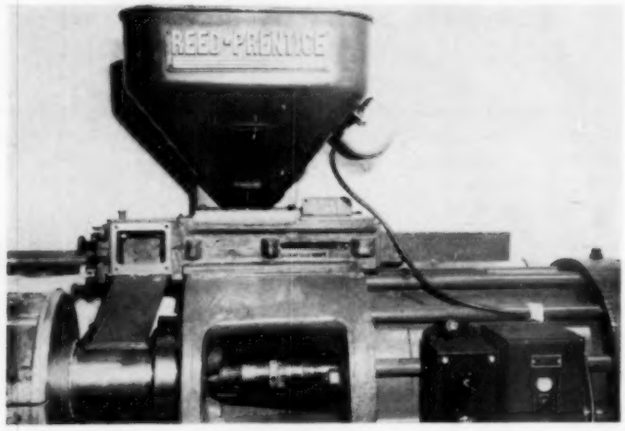


Mold Hoist — Mounting Pads



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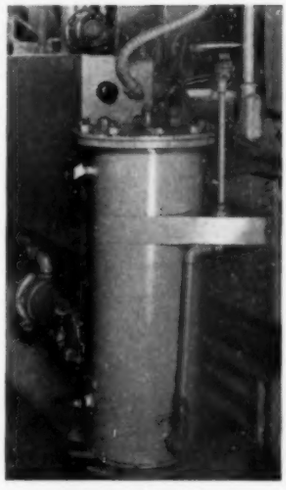
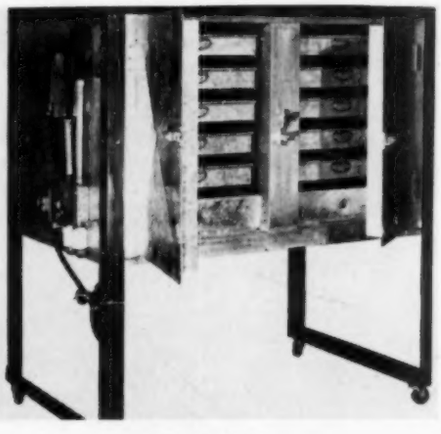
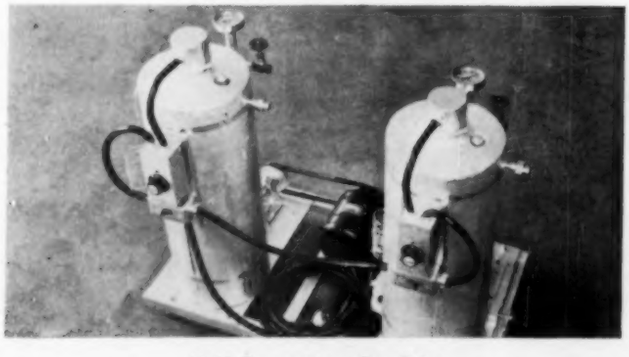


Integral Oil Filter

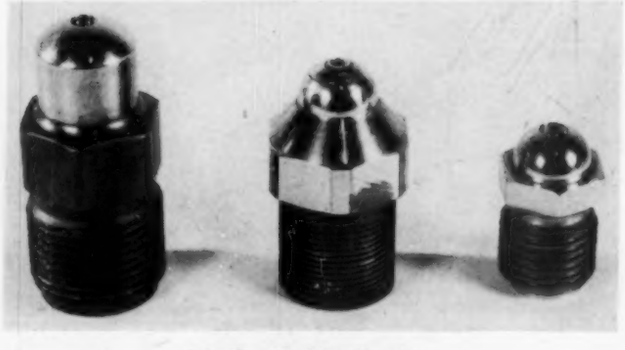
Portable Oil Filter



Drying Ovens



Mold Temperature Regulator



Injection Machine Nozzles

Empirical Factors in Injection Machine Design

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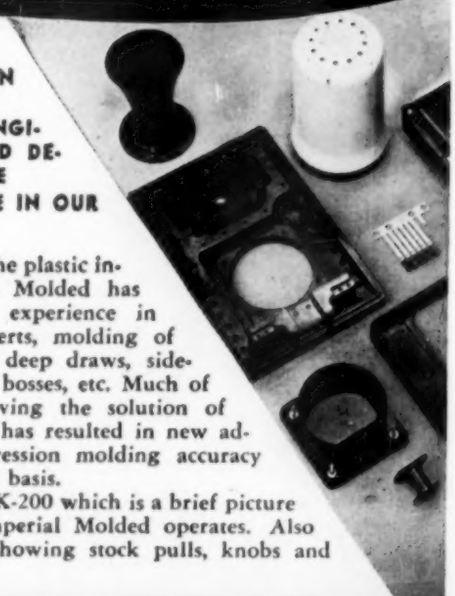

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CHOICE OF MOLD STEELS DISCUSSED AT NEWARK

By HAROLD SCHOR

Use of mold steels, a much misunderstood topic in the plastics industry, was the subject of the evening at the December meeting of the Newark Section, held at the Newark Athletic Club. Mr. George E. Brumbach, Chief Metallurgist of the Carpenter Steel Company, Reading, Pa., outlined the development and selection of mold steels. (In the following resume of Mr. Brumbach's talk, it should be noted that the SPE does not necessarily recommend Carpenter or any other brand of steels; Carpenter trade names are used for convenience.)

According to Mr. Brumbach, development of mold steels began in about 1915. At that time Carpenter was supplying materials to a concern which was engaged in the manufacture of phenolic auto ignition equipment. The parts consisted of the distributor head and the thimble through which the leads connect onto the head. Quite a bit of difficulty was encountered in the hobbing of the machinery steel which was recommended at that time for the application. In most cases, the molds were eventually completed by machining, and there was a great deal to be desired from the standpoint of cleanliness when using that grade of steel. Accordingly, a program of developing mold steels that could be cold hobbed and machined was started. The following series of steels were developed shortly after that time:

Brand Name	Remarks	Analysis
Norswede	a good hobbing iron having maximum hobbability	C. 0.8% max, balance iron
No. 1 Samson	good hobbability and higher core strength	C 0.10%, Cr 0.60%, Ni 1.25%
No. 2 Samson	for machined molds and forces	C 0.15%, Cr. 0.60%, Ni 1.25%
No. 158	for large machined cavities, high core strength	C 0.10%, Cr 1.50%, Ni 3.50%
Stentor	machined cavities, high core strength and accuracy in hardening	C 0.90%, Mn 1.65%
Stainless No. 2	AISI Type 420 for corrosion resistance	C 0.30%, C. 13.00%

These analyses represent the principal standard grades which have been established for various types of plastic molding from the earlier days until the present. A number of them are still being used quite widely, although there has been a general trend in the requirements toward steels of higher core strength and greater hobbability.

In the interest of mold steel improvements, several

new steels have been brought out within the last two years. These are:

Samson Extra	high core strength good hobbability	C 0.10%, Cr 2.0%
Super Samson	high core strength with limited hobbability	C 0.07, Cr. 5.0, Mo 0.75%, V 0.35%

Mr. Brumbach showed numerous slides, illustrating typical examples of all of these mold steels. Other slides were also shown illustrating the improvements in the two new mold steels with emphasis on the increased hobbability of Samson Extra over No. 1 Samson and also the high core strength and resistance to abrasion at elevated temperatures of Super Samson. The address also included a number of slides illustrating various methods of cold hobbing and also some of the difficulties which are encountered when proper precautions are not taken.

Before the dinner the Directors met to discuss plans for the special Newark Section Guest Night, to be held on February 9th. Feature of the Guest Night will be the Modern Plastics prizewinning exhibits, and a talk by Mr. Hiram McCann, Editor of Modern Plastics.

The January meeting of the Newark Section will have as its theme "Selecting the Right Plastics Material." Speakers of the evening will be Mr. Emile Mc K. Beekman of the Signal Corps Engineering Laboratories, and Mr. Robert Burns of the Bell Telephone Laboratories.

VINYL RESINS GROW UP

By F. A. RIDEOUT
Technical Representative, Bakelite Corporation

Vinyl resins are a variety of synthetic, clear-transparent solids. As a group, they are characterized by being chemically stable and physically tough. Unlike the simpler pure chemical compounds, with which the chemist is most familiar, these vinyl resins do not have a sharp melting point but melt or soften over a wide temperature range. The vinyl resin which will be given the most attention begins to soften at approximately 250 deg. F. and does not become fluid enough to flow visibly under its own weight until approximately 450 deg. F. It is within this range that vinyl plastics are usually formed or processed. Immediately upon cooling the properly formulated vinyl plastic will exhibit its useful properties. This cycle of softening, forming, and cooling may be repeated many times. This property is called "thermoplasticity" and therefore these resins are classed as thermoplastic.

Chemically the vinyl resins are related by the common "vinyl" radial. Many chemicals with this configuration with many different groups in **this** position are known to polymerize and form high molecular weight long chain compounds.

When activated by ultraviolet light or a catalyst such as an organic peroxide these unsaturated monomers will form long chain saturated polymers. Frequently when two monomers are mixed they will interact to form copolymers where both vinyl groups occur on the same molecular chain. The length of chain may be varied by control of reaction conditions which will have an effect on some of the material's properties. Vinyl polymer manufacture in its simplest terms is raw material purification and requires extremely careful control of reaction conditions.

Solutions of these resins are limited to fairly low solids. This is especially true of the tougher, more resistant high chloride-high molecular weight resins. The

(Please turn to Page 32)

Answer to thumbnail sketch: Carl E. Holmes of American Plastic Engineering Corp.

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by

WALTER KOSY

CARL H. WHITLOCK, formerly branch manager of the Detroit Office of the Monsanto Chemical Company announces the formation of C. H. Whitlock Associates at 1601 Fisher Building. The new company will act as trade representatives in the Detroit area for Nixon Nitration Works and the Catalin Corporation. They will also engage in engineering and development work in the plastics field.

MR. DALE STRONG, has been appointed purchasing agent for United Plastics and Industries, Inc. in Vasser, Michigan. Mr. Strong was formerly with Continental Can in Cambridge, Ohio.

JOHNNY KOONS, general manager of the Process Mold Company announces that RUSSELL LIVERMORE is now representing the company in Michigan. Mr. Livermore also represents the Nickol Hard Chrome Company in this area.

Our thumbnail sketch:

This month's personality is a real down east Yankee who came to Detroit by way of Denver, Colorado. Born in West Stewartstown, New Hampshire, on August 21, 1896, he spent is boyhood in New Hampshire and Vermont. After graduating from New Hampshire High School he spent several years at Boston Tech studying mechanical engineering. The advent of World War I interrupted his education and he saw service in the Royal Canadian Air Force.

With the end of the war, he went west and took a job with a compression molder in Denver, Colorado, where he eventually became general manager. After eight years in Denver he came to Detroit to become assistant manager in charge of the Plastic Mold Department at Quarnstrom Tool Company.

In 1942 he organized his own company of plastic mold designers and builders which has grown into the present organization of designers and developers of new ideas in plastics with business contacts from Mexico to Canada.

Along with these activities he found time to teach several courses in plastics at the Lawrence Institute of Technology and to take an active part in the SPE of which he is a charter member. He has served outstandingly on various committees and at present is a Director and Secretary-Treasurer of the Detroit Chapter. His favorite recreation is hunting and fishing. Who is he?????? (See page 31).

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Vinyl Resins *(from page 31)*

resin must be handled in its final state of polymerization and only the cyclic ketones, nitroparaffins and other relatively expensive solvents will make clear solutions, even then at low solids.

Within the last several years a technique has emerged from the laboratories and successfully worked out commercially for handling the toughest and least soluable of these copolymers as a dispersion of high solids content, and fluid, in inexpensive petroleum thinners. These are organosols which are prepared by pebble milling a special new grade of powdered copolymer, called VINYLITE VYNV resin, in a carefully balanced thinner composition along with plasticizer, pigments, and other resin modifiers. This high solids "dope" or dispersion may then be readily spread or sprayed onto a metal surface or onto cloth or paper, quickly dried of volatile thinner and then fluxed into a continuous strong film by a brief exposure to 300-350 deg. F. heat.

In August, 1946, the Plastic Materials Manufacturers Association estimated that export amounted to about 8 per cent including export to Canada, so most of the vinyl resins are sold in this country. The most recent figures published show about 138,000,000 pounds per year production rate. Adding the planned production of facilities now being constructed or expected to be in operation by the end of 1948, the Modern Plastics Magazine shows 250,000,000 pounds per year rate. Present indications are that even this amount will be sold out.

The major part of the increase indicated in 1945 was under construction before the war started; before our rubber supply was even threatened. Long before Pearl Harbor vinyl resins were proved and preferred over rubber for many Navy uses for wire insulation. In fact, the Navy recognized the merits of these resins as early as November 1936, when vinyl resins were first approved for many marine electrical applications. The war interrupted the planned development and diversification of these resins. Even though vinyl chloride and copolymer resins were the tenth raw material to be put under allocation by the War Production Board at the early part of the war, building new plants was strictly controlled, and we could not expand for civilian requirements. Even today shortages of building materials interfere with the construction of production facilities to meet a rising demand for the vinyl resins. We are in the unfortunate position of having to allocate the short supply as equitably as possible to prevent undue hardships among users of these materials.

While we have said vinyl resins have grown up, we think you can agree that resins having these properties have many promising years of growth ahead as industry takes advantage of their distinctive properties. The research chemist knows there are many combinations of vinyl monomers still to be studied. New resins bring new properties; new properties, if desirable ones, expand applications in directions unpredictable beforehand!

It improves waistlines

... and so many more things, too!

THE supple belting pictured here does a wonderful job of perking up women's clothes—it is so attractive and colorful.

It is made of a Geon plastic compound—a versatile elastomeric material that is ideal also for webbing or matting, welting, beading, and decorative trims.

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Geon plastic compounds extrude easily, and can also be compression molded and calendered. The finished extrusions have excellent tensile strength and resistance to flexing and abrasion. They are readily adaptable to unusual die designs—give high gloss without fire polish. They have remarkable low temperature and sunlight properties, and can be embossed.

We'll gladly send you further information about these highly useful plastic compounds; ask about Geon plastic 8580—the one used in making belting and many other products. Please write Department SPE, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15 Ohio.

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BLUE	TAN
DARK BLUE	YELLOW
GREEN	WHITE
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